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Tosirou YAMAGUCHI, et al.

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FOR: PAINT ROLLER

LETTER SUBMITTING AN ENGLISH TRANSLATION OF THE PRIORITY DOCUMENT

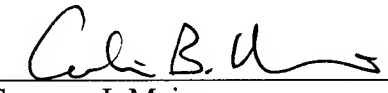
COMMISSIONER FOR PATENTS
Alexandria, VA 22313-1450

Sir:

Responsive to the non-Final Official Action dated April 29, 2009, submitted herewith is an English Translation of the priority document, together with a Declaration verifying the accuracy of the translation. It is requested that the attached English translation be used as the copy for examination purposes in the Office.

Respectfully Submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



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DECLARATION

I, Chizuko IKEDA, declare that I reside at 5-50-301, Makita-cho, Takatsuki-shi, OSAKA 569-0855 JAPAN;

That I am familiar with the English and Japanese languages;

That I have prepared a translation of Japanese Patent Application No. 355921/2003, "ペイントローラー, PAINT ROLLER"; said translation thereof being attached hereto and made a part of this declaration;

That to the best of my knowledge and belief, the attached translation is accurate and fairly reflects the contents and meaning of the foregoing Japanese language document.

I declare, under penalty of perjury under the laws of the United States of America, that the foregoing is true and correct.

Executed, on July 17, 2009.

Chizuko Ikeda

Chizuko IKEDA

JAPAN PATENT OFFICE

This is to certify that the annexed is a true copy of the following application as filed with this Office.

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September 1, 2004

Commissioner,

Japan Patent Office Hiroshi OGAWA

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[Attached Documents]

[Item]	Claims	one copy
[Item]	Description	one copy
[Item]	Drawing	one copy
[Item]	Abstract	one copy
[Identification No. of General Power]		9108233

[Document Name] Claims

[Claim 1]

A paint roller comprising a liquid-impermeable tubular core member and a cover member attached on a surface of the core member, wherein

the tubular core member has an engaging element having a male structure of a separable fastener on the surface thereof, and the engaging element has a height of 0.3 to 3.5 mm,

the cover member has a female structure of a separable fastener on an inner surface thereof, and

the core member is attached to the cover member with a male-female engagement between the male structure of the engaging element of the tubular core member and the female structure of the inner surface of the cover member.

[Claim 2]

The paint roller according to claim 1, wherein the density of the engaging element on the surface of the tubular core member is 30 to 150 per cm^2.

[Claim 3]

The paint roller according to claim 1 or 2, wherein the cover member is spirally wound around the surface of the tubular core member for being attached to the core member.

[Claim 4]

The paint roller according to claim 1 or 2, wherein the cover member having a piece(s) of a given shape and dimension is attached in a given pattern on the surface of the tubular

core member with the male-female engagement between the engaging element of the surface of the tubular core member and the inner surface of the cover member, and

the paint roller is capable of transferring the given pattern.

[Claim 5]

The paint roller according to any one of claims 1 to 4, wherein the tubular core member comprises a separable fastener male tape and a tubular object, and the separable fastener male tape has an engaging element having a male structure on a surface thereof and is spirally wound around a surface of the tubular object.

[Claim 6]

The paint roller according to claim 5, wherein the tubular object and the separable fastener male tape are made of a synthetic resin.

[Claim 7]

The paint roller according to any one of claims 1 to 6, wherein the cover member is a fabric having a pile on an outer surface thereof and having a loop on an inner surface thereof, wherein the loop is engaged with the engaging element having the male structure provided on the surface of the tubular core member with the male-female engagement.

[Claim 8]

The paint roller according to any one of claims 1 to 7, wherein the cover member is a fabric comprising a

base which is woven or knitted from at least a thread having a loop, and the fabric has the loop on an inner surface thereof, and the loop is capable of engaging with the engaging element of a surface of the tubular core member by means of the male-female engagement.

[Claim 9]

The paint roller according to any one of claims 1 to 8, wherein the cover member is a fabric having a pile on an outer surface thereof and containing a heat-fusing fiber in a base constituting the fabric, and wherein in the base, the heat-fusing fiber is heat-welded together with other heat-fusing fiber, as well as with other fiber.

[Document Name] Description

[Title of the Invention] PAINT ROLLER

[Technical Field]

[0001]

The present invention relates to a paint roller. More specifically, the present invention relates to a paint roller comprising a tubular core member (tubular core part) and a cover member attached on the surface of the core member. In the paint roller, the cover member is removable from the tubular core member and easily exchangeable for a new cover member when the cover member becomes dirty, damaged, or worn. In the paint roller of the present invention, the tubular core member is reusable repeatedly. Moreover, the present invention provides a paint roller with which a design (or figure, mark) having a desired pattern, mark and others can be painted on a surface of an object to be painted. Further, in the paint roller, a kind or content of a painting pattern on a surface of an object to be painted is freely (flexibly) changeable according to each aspect (or circumstance).

[Background Art]

[0002]

Conventionally, a paint roller has been produced by spirally (or helically) winding (or wrapping) a cover member such as a fabric around a tubular core member which is formed from a cardboard (or a chipboard) or a resin-impregnated paper and bonding the cover member to the tubular core member,

followed by inserting a handle into the tubular core member to attach the handle to the tubular core member.

Specifically, the paint roller is produced by a series of steps as follows: a step for simultaneously supplying (or feeding) a plurality of strip-shaped (band-shaped) cardboards or resin-impregnated papers in conjunction with spirally winding the strip-shaped (band-shaped) cardboards or resin-impregnated papers around a mandrel with applying an adhesive, to form a tubular core member; a step for winding a strip-shaped (band-shaped) fabric (cover member) onto the tubular core member with applying an adhesive to the inner (back) surface of the fabric (cover member); a step for cutting a laminate (laminated product) comprising the core member and the cover member into an appropriate length; a step for heating the laminate in a heating furnace to harden (or cure) the resin which is impregnated into the paper, as well as to dry or harden the adhesive; a step for cutting the cured laminate into a given size of a roller; a step for arranging (or adjusting) a fluff (or fuzz) on the surface with a card cloth brush and the like for finish; a step for attaching a handle; and others. Thus, since such a process requires an extremely large number of the steps and is very complex, the production of the paint roller is required much labor and time. Further, in the case where a solvent-based adhesive is used in the step for winding a cardboard or resin-impregnated paper around a mandrel, or the step for winding a strip-shaped fabric for the cover

member around the tubular core member, and the like, the organic solvent in the adhesive causes some problems. For example, the organic solvent corrodes the tubular paper formed by winding the strip-shaped paper around the mandrel. Further, due to the organic solvent, deterioration of the working environment, pollution of natural environment, and the like occur. Therefore, it has been necessary to select an adhesive not causing such problems.

[0003]

In order to resolve the aforementioned problems of the related art, there is a proposed process for producing a paint roller, the process comprises spirally winding a tape (strip) comprising a thermoplastic resin such as a polypropylene around a mandrel to form a core tube instead of forming the core tube from a cardboard or a resin-impregnated paper, applying an adhesive comprising a molten resin such as a molten polypropylene to the core tube, spirally winding a strip-shaped fabric cover member to bond the fabric cover to the core tube by use of the adhesive, then cutting the resulting roller into a given size, conditioning a fluff on the surface with a card cloth brush, and attaching a handle to the core tube (see Patent Document 1).

Additionally, there is a proposed process for producing a paint roller, the process comprises heat-fusing a surface of a thermoplastic resin core tube with a heat source which is located parallel to the core tube, with

helically winding a fabric cover over the surface of the core tube to obtain a paint roller in which the fabric cover is integrally bonded to the core tube without applying an adhesive between the core tube and the fabric cover (see Patent Document 2).

[0004]

Since there is no need to use an adhesive containing an organic solvent in these processes described in Patent Documents 1 and 2, these processes do not cause problems such as deterioration of the working environment and pollution of natural environment due to organic solvents, and further these processes are excellent in safety and sanitary. However, in the paint roller obtained from these processes described in Patent Documents 1 and 2, as the same as the above-mentioned conventional paint roller, the core tube (tubular core member) and the cover member are strongly bounded and integrated. Accordingly, when the cover member becomes dirty, damaged, or worn, even if there is no damage in the core tube (tubular core member), it is necessary to discard the whole paint roller. Thus, these processes are problematic in an effective utilization of resources, economical efficiency and the like.

[0005]

From the above viewpoint, there is a proposed paint roller which comprises a paint roller body (tubular core member) and a cover member wound along with a guide projection (or protuberance) line which is formed spirally on the

surface of the paint roller body (tubular core member), wherein a pressure-sensitive adhesive is applied to the inner surface of the cover member in order to reuse the paint roller body (tubular core member). In such a paint roller, when a cover member of the paint roller becomes dirty or damaged, reuse of the paint roller body is achieved by exchanging only the cover member (see Patent Document 3).

In the paint roller described in Patent Document 3, since the cover member is adhered (or bonded) to the surface of the paint roller body by use of the pressure-sensitive adhesive, when the cover member becomes dirty or damaged, the cover member can be removed from the paint roller body, and another new cover member can be adhered to the body. Thereby, the paint roller body is reusable.

[0006]

However, since a fabric used for a cover member of the paint roller needs to uniformly hold enough amount of a paint upon a painting work operation, the fabric is much thicker than a substrate such as a paper or a resin-impregnated cloth used in a general purpose adhesive tape, and further has a porous structure having many voids throughout fibers thereof. Thus, in order to apply a pressure-sensitive adhesive in a uniform thickness without excessively applying to the inner surface of such a thick and porous cover member (fabric), a special equipment(s) or a step(s) are additionally required. As a result, the

production cost of the cover member having a pressure-sensitive adhesive layer is inevitably greatly increased. Accordingly, even if the paint roller body is repeatedly reusable, since the cover member becomes expensive because of the pressure-sensitive adhesive layer, such a cover member does not comply with the purpose for reducing the cost of the paint roller by preventing a throwaway of the cover member.

[0007]

Further, in an environmentally friendly paint or an environmentally safe paint in resent years, because of an attempt to decrease the use of an organic solvent in a paint, the viscosity of the paint itself becomes considerably high. As a result, a paint roller used for painting with such a highly viscous paint tends to lose a fiber(s) by fiber shedding in a pile fabric constituting the cover member. In particular, the shedding is significant in the cover member comprising a sliver-knit material. In order to avoid the fiber shedding in the pile fabric constituting the cover member, it is necessary to subject the inner surface of the pile fabric to a backing process. However, it is practically difficult to subject the inner surface of the pile fabric to the backing process with smoothly applying a pressure-sensitive adhesive.

[0008]

Moreover, the paint roller of Patent Document 3 also have a spiral guide projection (or protuberance) line as

a guide mean for adhering the cover member to the surface of the paint roller body (roll-shaped core member). Therefore, in many cases, the guide projection (or protuberance) line protrudes (or projects) from the cover member after winding the cover member around the paint roller body. In such a case, there is a problem that a good painting is not achieved due to a line appearing (or emerging) on the painted surface.

[0009]

Further, in the case of drawing a given design, figure, and others with a paint roller, a paint roller having a predetermined design, figure, and others carved on a surface thereof, a so-called effect roller, is usually employed. Since a figure(s) to be expressed (drawn) by painting has been already pre-engraved to the surface of such a conventional effect roller, the pattern cannot be freely changed. Therefore, in the case of painting another design or figure, it is necessary to purchase or to produce another effect roller having another pre-engraved design or figure.

On the other hand, in the above described conventional paint roller or the paint rollers described in Patent Documents 1 to 3, since the cover member comprising a predetermined material is spirally wound around all the surface of the core tube (tubular core member), it is difficult to draw or paint on a surface to be painted by adequately selecting or changing a design, a figure, and the like having a desired pattern with such a paint roller.

[0010]

[Patent Document 1] US Patent No. 5572970 specification

[Patent Document 2] US Patent No. 4692975 specification

[Patent Document 3] JP-U-57-76879 publication

[Disclosure of the Invention]

[Problems to be Solved by the Invention]

[0011]

It is an object of the present invention to provide a paint roller, in which a tubular core member is repeatedly usable (reusable) by exchanging only a cover member which has been dirty, damaged, or worn into a new cover member.

Another object of the present invention is to provide a paint roller which can be produced safely and sanitarily in a good production efficiency by a simple step, without using an adhesive containing an organic solvent and the like, and further without employing an expensive equipment(s) or a complex step(s) and in which a cover member is exchangeable as well as a tubular core member is reusable.

It is still another object of the present invention to provide a paint roller, with which a worker (or operator) can arbitrarily and adequately exchange a design, a figure or the like to be painted, and can form a desirable design, figure or the like on a surface to be painted by using the paint roller at the painting site.

[Means to Solve the Problems]

[0012]

The inventors of the present invention made intensive studies to achieve the above objects and finally found that in stead of using the conventional attaching method or manner and the methods or manners described in Patent Documents 1 to 3 (e.g., an adhesive, a pressure-sensitive adhesive, or a heat-fusing action of a core material itself) for attaching a cover member on a surface of a tubular core member of a paint roller body, a tubular core member having a number of engaging elements of a male structure (or function) of a separable fastener in a manner protruded on a surface thereof and a cover member having a female structure (or function) of a separable fastener on an inner surface thereof are used to attach the cover member on the surface of the tubular core member with a male-female engagement between the male structure and the female structure. The inventors also found that this attachment with the male-female engagement has the following advantages: in use of the paint roller, the cover member is attached firmly and stably on the surface of the tubular core member, whereby a painting work operation can favorably be carried out; and when an exchange of the cover member is required due to the dirt, damage or wearing of the cover member, the cover member is easily removable from the surface of the tubular core member by hand and the like, and a new cover member can be attached extremely simply and firmly on the core member by an engagement (male-female engagement)

between the engaging element of the surface of the tubular core member and the female structure of the inner surface of the cover member.

[0013]

Moreover, the inventors of the present invention found the following: in order to attach the cover member exchangeably on the surface of the tubular core member by the above-mentioned male-female engagement, when the engaging element having a male structure to be provided on the surface of the tubular core member has a height of 0.3 to 3.5 mm, an engagement strength between the engaging element and the inner surface of the cover member can be held at a high level. Further, no gap or void generates or produces at the boundary between the surface of the tubular core member and the inner surface of the cover member. Accordingly, a stain on a surface to be painted or a painting defect due to a paint leakage does not occur, by preventing the paint from entering to the boundary part.

[0014]

Further, the inventors of the present invention found the following: the cover member can be attached on the surface of the tubular core member of the paint roller using the above-mentioned separable fastener manner by spirally winding the cover member around the surface of the tubular core member, as found in the conventional manner, and in this case, a paint roller in which all over the surface of the tubular core member is covered with the cover member

can easily be obtained.

[0015]

Furthermore, the inventors of the present invention found the following: when the separable fastener manner found by the inventors is utilized, cut piece(s) of the cover member having a given dimension and shape can be attached to any place on the surface of the tubular core member at any arrangement in a desired pattern (design or figure), whereby a desired effect roller can be obtained, and a desired design or figure can be painted on a surface to be painted according to the pattern of the effect roller. In addition, in such an effect roller using the separable fastener manner, the kind of the pattern can be variously altered by changing the shape, the dimension, the species or the like of the cover member piece(s) to be attached on the surface of the tubular core member at the site of the painting working operation. Thus, any design, figure or the like can be very easily painted on a surface to be painted by one paint roller.

[0016]

Moreover, the inventors of the present invention found that the tubular core member having an engaging element having a male structure on a surface thereof can easily be produced by spirally winding a separable fastener male tape having an engaging element having a male structure on a surface thereof around a surface of a tubular core object.

Further, the inventors of the present invention found that a fabric having a loop on an inner surface thereof, the loop being engaged with the engaging element of the surface of the tubular core member with the male-female engagement, is preferably used as a cover member having a female structure on an inner surface thereof, and that such a fabric (cover member) can be woven or knitted from at least a thread having a loop.

Furthermore, in the fabric as the cover member, by weaving or knitting a heat-fusing fiber into a base (a ground) and heat-fusing the heat-fusing fiber together with other heat-fusing fiber(s) and with other fiber(s), a pile provided on the surface of the cover member (fabric) is firmly welded on the base, whereby falling out of the pile is avoided. In addition, when the cover member has a loop serving as a female structure on an inner surface thereof, the loop is stable and in a fixed state and successfully exhibits the female structure (function) over a long period of time. The present invention was accomplished based on the above various findings.

[0017]

That is, the present invention includes

(1) a paint roller comprising a liquid-impermeable tubular core member and a cover member attached on a surface of the core member, wherein

the core member has an engaging element having a male structure (or function) of a separable fastener on the

surface thereof, and the engaging element has a height of 0.3 to 3.5 mm,

the cover member has a female structure (or function) of a separable fastener on an inner surface thereof, and

the core member is attached to the cover member with a male-female engagement between the male structure of the engaging element of the surface of the tubular core member and the female structure of the inner surface of the cover member.

[0018]

The present invention also includes

(2) the paint roller of the above (1), in which the density of the engaging element on the surface of the tubular core member is 30 to 150 per cm^2;

(3) the paint roller of the above (1) or (2), in which the cover member is spirally wound around the surface of the tubular core member for being attached to the core member; and

(4) the paint roller of the above (1) or (2), in which the cover member having a piece(s) of a given shape and dimension is attached in a given pattern on the surface of the tubular core member with the male-female engagement between the engaging element of the surface of the tubular core member and the inner surface of the cover member, and the paint roller is capable of transferring the given pattern.

[0019]

Further, the present invention includes

(5) the paint roller of any one of the above (1) to (4),

in which the tubular core member comprises a separable fastener male tape and a tubular object, and the separable fastener male tape has an engaging element having a male structure on a surface thereof and is spirally wound around a surface of the tubular object; and

(6) the paint roller of the above (5), in which the tubular object and the separable fastener male tape are made of a synthetic resin.

[0020]

Moreover, the present invention includes

(7) the paint roller of any one of the above (1) to (6), in which the cover member is a fabric having a pile on an outer (or upper) surface thereof and having a loop on an inner (or under) surface thereof, wherein the loop is engaged with the engaging element having the male structure on the surface of the tubular core member with the male-female engagement;

(8) the paint roller of any one of the above (1) to (7), in which the cover member is a fabric comprising a base which is woven or knitted from at least a thread having a loop, and the fabric has the loop on an inner surface thereof, and the loop is capable of engaging with the engaging element of a surface of the tubular core member by means of the male-female engagement; and

(9) the paint roller of any one of the above (1) to (8), in which the cover member is a fabric having a pile on an outer surface thereof and containing a heat-fusing fiber

in a base constituting the fabric, and wherein in the base, the heat-fusing fiber is heat-welded together with other heat-fusing fiber, as well as with other fiber.

[Effects of the Invention]

[0021]

In the paint roller of the present invention, when an exchange of the cover member is required due to the dirt, damage or wearing of the cover member, the cover member is easily removable from the surface of the tubular core member by hand and the like, and a new cover member can be attached extremely simply and firmly to the core member by an engagement between the male element on the surface of the tubular core member and the female structure on the inner surface of the cover member. Such that, the tubular core member can be used repeatedly.

In the paint roller of the present invention, an engagement strength between the element having a male structure, which exists on the surface of the tubular core member, and the inner surface of the cover member is held in high level. Further, no gap or void occurs at the boundary between the surface of the tubular core member and the inner surface of the cover member. Accordingly, a stain on a surface to be painted or a painting defect due to a paint leakage does not occur by preventing the paint from entering to the boundary part.

According to the present invention, the cover member to be attached to the surface of the tubular core member

can comprise a piece of the cover member having a desired shape and dimension, and the desired number of the piece of the cover member can be easily attached to the surface of the tubular core member by virtue of the engagement action in a desired pattern, by placing the desired number of cover member pieces in an adequate positioning condition, and the pattern can be optionally changed if necessary. Thus, any design, figure or the like can be very easily painted on a surface to be painted by one paint roller.

The paint roller of the present invention can be produced extremely simply and in good production efficiency, without an organic solvent or the like which is harmful to the environment.

[Best Mode for Carrying Out the Invention]

[0022]

The present invention will be illustrated in more detail below.

The present invention includes any paint roller comprising a liquid-impermeable tubular core member and a cover member attached on a surface of the core member, wherein the core member has a number of engaging elements with a male structure or function of a separable fastener (hereinafter such an engaging element is sometimes referred to as "a male element") and with a height of 0.3 to 3.5 mm from the surface thereof, the cover member has a female structure or function of a separable fastener on an inner surface thereof, and the core member is attached to the

cover member with a male-female engagement between the male elements and the inner surface of the cover member.

Therefore, the present invention embraces both paint rollers (1) and (2), which are described bellow: (1) a paint roller in which a cover member has a female structure of a separable fastener (a hook and loop fastener) on an inner surface thereof, and the cover member is attached to all or almost all over the surface of a tubular core member having a male element by means of the engagement (a paint roller in which all or almost all over the surface of a tubular core member is covered with the cover member); and (2) a paint roller in which a cover member (a cover member piece) has a female structure of a separable fastener on the inner surface thereof, and the cover member is attached to part of the surface of a tubular core member having a male element by means of the engagement (a paint roller in which part of the surface of the tubular core member is covered with the cover member).

[0023]

The above described paint roller (1) can be preferably used for, for example, a uniform painting of a surface to be painted. In the above paint roller (1), the cover member may be attached to the (outer) surface of the tubular core member having a male element on the surface thereof, preferably in a way by spirally winding the band-shaped (strip-shaped) cover member around the surface of the tubular core member with engaging or fastening the male

element and the inner surface of the cover member with the engagement. In this way, the cover member can be attached firmly and stably to all over the surface of the tubular core member. Upon the painting work operation and so on, a displacement (or slippage), a peeling (or removal, separation, stripping) and the like of the cover member on the surface of the tubular core member hardly occur. Moreover, since the cover member can be wound uniformly around all over the surface of the tubular core member, it is possible to obtain a paint roller which does not generate a paint stain and the like. Upon winding the cover member around the tubular core member, in the case where some defects are found in the winding manner (e.g., in the case where a gap occurs between the cover and tubular core members because of failure of tight winding), a paint roller realizing a uniform painting can be obtained by such a simple readjustment (or retouch) that the wound cover member is removed (or peeled off) once and wound again.

[0024]

Moreover, in the above paint roller (2) of the present invention, the cover member is attached to part of the (outer) surface of the tubular core member. The paint roller (2) is preferably usable for painting a desired design or pattern on a surface to be painted. In the above-described paint roller (2), an attachment position on the surface of the tubular core member with the male element, a shape, a dimension, and the number of cover member pieces to be

attached to the surface of the tubular core member can be optionally selected. Depending on the intended design, figure, pattern and the like on a surface to be painted, the cover member piece(s) having an appropriate shape and size can be attached simply and firmly to the surface of the tubular core member in an adequate number and positioning condition, with the engagement between the male element present on the (outer) surface and the female structure part on the inner surface of the cover member. The cover member piece(s) attached to the surface of the tubular core member can be easily exchanged for another cover member having another size, shape and the like, depending on the intended designs, figures, patterns and the like on a surface to be painted, at a painting site (place or area).

[0025]

The tubular core member constituting the paint roller body of the present invention comprises a tubular core member which is made of a liquid-impermeable material and which has a number of male elements uniformly or almost uniformly all over the surface of the roller. This tubular core member is excellent in strength and rigidity, free from deformation and damage upon the painting work operation, lightweight, and outstanding in the handling facility. Further, the material or the detail structure of the tubular core member is not particularly limited to a specific one, as long as the male element existing on the tubular core member has a height of 0.3 to 3.5 mm and can sufficiently maintain

the engagement with the female structure, without causing deformation or damage by frequent attachment and peeling operations of the cover member.

[0026]

Among others, it is preferred that the tube body part of the tubular core member be made of a synthetic resin, especially a liquid-impermeable thermoplastic resin which is excellent in strength, rigidity, impact (or shock) resistance and the like. The diameter (outer diameter) of the tube body part of the tubular core member is not particularly limited to a specific one, and can be determined depending on an application, a type of usage, and the like of the paint roller. The diameter is generally 1.5 to 6 cm in view of handling facility, painting facility, easy production and the like. The diameter is more preferably 1.4 to 4.5 cm. Moreover, the length of the tubular core member of a final paint roller can be also selected depending on a usage, a using method and the like of the paint roller, and it is preferred that the length be generally 2 to 50 cm, and particularly 15 to 30 cm.

[0027]

The male elements which exist on the surface of the tubular core member may be a male element derived from a woven or knitted hook-and-loop type fastening male member. It is preferred to use a male element which is the same kind or derived from a separable fastener obtained by a melt molding such as a melt extrusion molding (i.e., a male

member in which a male element made of a thermoplastic resin and a basis comprising the same thermoplastic resin are bonded or attached into one piece) from the viewpoint of unraveling (or not generating snag(s)) in the male element, and easy unification by attachment and bonding of the male member sheet to the tubular core member. In the above case, it is preferred that the separable fastener male member be formed by melt-molding from a thermoplastic resin such as a polypropylene, a polyamide, a polyvinyl chloride, or an aromatic polyester, because the production of the separable fastener male member is easy, and the engaging or connecting ability of the male element is high, and further the male element is excellent in durability. In particular, from the viewpoint of easy incineration in addition to the above excellent properties, the element made of the polypropylene is more preferable.

[0028]

With respect to the shape and structure of the male element existing on the surface of the tubular core member, depending on the shape and form of the female structure part on the inner surface of the cover member, an element having an appropriate shape and structure can be selected from a variety forms of the conventionally known male elements in order to effectively achieve the engagement between the male element and the inner surface of the cover member. The shape and structure of the male element which can be employed in the present invention is not limited

to a specific one, and may include, for example, a hook shape exemplified in Fig. 1 (a) to (c), a mushroom shape exemplified in Fig. 1 (d), and a T-shape exemplified in Fig. 1 (e).

[0029]

It is necessary that the height of the male element existing on the surface of the tubular core member be 0.3 to 3.5 mm. The height is preferably 0.5 to 2.5 mm, and more preferably 0.5 to 1.5 mm. In the case where the height of the male element is less than 0.3 mm, the engagement strength between the male element and the female structure part on the inner surface of the cover member decreases, and the cover member is peeled from the surface of the tubular core member with a small external force, resulting in difficulty of the painting work operation. On the other hand, in the case where the height of the male element is over 3.5 mm, due to a gap caused between the surface of the tubular core member and the cover member attached to the core surface in the engagement, the paint enters into the gap and the leakage of the paint occurs. As a result, the painting work operation cannot be conducted smoothly.

Incidentally, the height of the "male element" used herein refers to the distance between the surface of the basis from which the male element is upstanding and the top part (the highest part) of the male element. Referring to the male elements in Fig. 1 (a) to (e) for explanation, the height of the "male element" denotes a height (or

dimension) shown by "H" in each Figure.

[0030]

The density of the male element of the surface of the tubular core member should be selected depending on a shape and structure of the male element, a height of the male element, a dimension of the engaging part of the male element, a thickness dimension and diameter of the male element, a structure and density of the female part on the inner surface of the cover member, and the like. In general, the density of the male element is preferably 30 to 150/cm^2, and particularly 60 to 100/cm^2. The male element having such a density contributes to an effective engagement between the male element and the female structure part on the inner surface of the cover member. Moreover, in the case where the cover member needs to be smoothly peeled from the tubular core member, the cover member can be peeled from the core member without applying an excessive force damaging the inner surface of the cover member and the male element itself.

[0031]

The process for producing a tubular core member constituting the paint roller of the present invention is not particularly limited to a specific one, the core member may be produced by using any processes capable of producing the tubular core member having the above described structure. Among a variety of production processes, a preferably employed one is a process for producing a tubular core member

having a male element on a surface thereof. That is, the tubular core member is producible by winding a strip-shaped male tape with the male element on a surface thereof around the surface of a synthetic resin tubular object (tube body) with applying a hot-melt adhesive to the surface of the tube. This process is excellent in working efficiency and productivity. Moreover, the process does not require a solvent-containing adhesive which causes the deterioration of the working environment, pollution of natural environment, and the like.

In the above case, a pre-produced synthetic resin tubular object (tube body) may be used as a synthetic resin tubular object, or the male tape with the male element on the outer surface may be wound around and adhered to the tubular object, while producing the tubular object. In view of further improvement in productivity by making the steps continuous, the latter process for producing the tubular object synchronized with the winding the strip-shaped male tape is desired. In particular, the following production process is preferred.

[0032]

That is, a process comprising the following steps is particularly preferred: (i) spirally winding a strip-shaped sheet (band-shaped sheet, tape) comprising a thermoplastic resin around a mandrel to form a tubular object (tube-shaped object), (ii) with supplying a molten (heat-softened) thermoplastic resin in the form of a tape

(band-shaped film) (spirally winding the molten thermoplastic resin onto the strip-shaped sheet or around the tubular object to cover the strip-shaped sheet or the tubular object) to form an adhesive layer, and (iii) further winding a strip-shaped male tape which has a male element on the surface and is made of a thermoplastic resin around the molten thermoplastic resin tape or the adhesive layer, with the male element facing outer surface. The process ensures to produce smoothly a tubular core member having the male element on the outer surface thereof in good workability and higher productivity.

[0033]

The synthetic resin constituting the above tubular core member may be any resin, as long as the synthetic resin is excellent in strength, rigidity, impact resistance, and lightness in weight, and has liquid-impermeability. The synthetic resin may be especially a thermoplastic resin. The synthetic resin may include, for example, a polypropylene, an aromatic polyester, a polyamide, and a polyvinyl chloride. Among these resins, the polypropylene is preferred in view of incineration. In the above process employing the mandrel, constitution of all of the strip-shaped sheet for making the tubular object, the thermoplastic resin for use as a hot melt adhesive, and the thermoplastic resin male tape with the polypropylene contributes to further improvement in the adhesion and unification between the tubular object (tube-shaped object)

and the male tape wound thereon, as well as high duration in the tubular core member with the male element. Moreover, the male element comprising a polypropylene and existing on the surface of the tubular core member hardly causes deformation and damage, and maintains its engaging function over a long period.

[0034]

The cover member to be attached to the surface of the tubular core member may be any cover member, as long as the cover member is excellent in the holding capacity of a paint as well as the painting performance, has the female structure on the inner surface of the cover member for connecting to the male element on the surface of the tubular core member, and comprises a material excellent in durability for painting work operation. As the cover member, a fabric may be preferably used in view of good paint-holding capacity and excellent painting performance, and easy formation of the inner surface having the female structure. As the cover member of the paint roller, a woven fabric is conventionally used. According to the present invention, however, either a woven fabric or a non-woven fabric can be utilized for the cover member.

The surface (upper surface or outer surface) of the cover member may or may not have a pile(s). From the viewpoint of the paint-holding capacity or the painting uniformity, it is preferred that the surface have a pile.

[0035]

According to the present invention, the cover member may include: (1) a cover member (fabric) which is produced as to express the female structure on the inner surface of the cover member (fabric) all at once (simultaneously); or (2) a cover member (laminated fabric) which is produced by preparing or fabricating a fabric such as a pile fabric having the paint-holding capacity and the uniform painting in advance, and bonding (laminating) another sheet or fabric having the female structure of the separable fastener to the inner surface of the fabric.

In particular, it is preferred to use the above cover member (fabric) (1), which is produced as to express the female structure on the inner surface of the cover member (fabric) all at once, because the above cover member (fabric) can be produced in an economical manner by a simple process and a simple equipment, without costing labor and time.

[0036]

The process for producing the cover member (1) is not particularly limited to a specific one, and the cover member may be produced by any processes, as long as a cover member (fabric) having a female structure on the inner surface can be produced, and such a cover member is excellent in a paint-holding capacity or a uniform painting. Especially, the cover member is producible smoothly and in good productivity according to the following process.

That is, there may be preferably used a process for producing the cover member (fabric) (1), which comprises

interlacing (weaving or knitting) a base (a ground) by using a thread having a loop (hereinafter, sometimes referred simply as "a loop thread") as at least part of a thread (a ground yarn) for a base. In this process, a fabric having a lot of small loops exposed on the inner surface of the cover member (fabric) can be formed, and these loops exhibit the female structure. As a result, the cover member is attachable to the surface of the tubular core member by the engagement between the female structure and the male element existing on the surface of the tubular core member.

[0037]

In the above cover member (1), in order to achieve a sufficient engagement strength between the loop and the male element on the surface of the tubular core member, when the number of male elements on the surface of the tubular core member per unit area is regarded as A pieces per cm^2 (A /cm^2), it is preferred that the number of loops (female elements) exposed on the back be usually, 0.5A to 3A /cm^2, and particularly 1A to 2.5A /cm^2.

In addition, the size of the loop exposed on the inner surface of the cover member should be adjusted to the size which realizes the good engagement therebetween, depending on the shape or size (height, diameter, thickness and so on), the degree of the flexibility and the like of the male element on the surface of the tubular core member. It is preferable that the size of the loop (the diameter of the loop) exposed on the inner surface of the cover member be

generally 100 μm to 3 mm.

[0038]

The number, the size, and the like of loops to be exposed on the inner surface of the cover member (fabric) can be determined by adjusting the number or the size of loops in the loop thread for the base, the number of loop threads used in producing the cover member (fabric), the kind of the weaving ground or knitting ground, the weight of the cover member (fabric), the density of the loop, and the like.

The loop thread used in weaving or knitting the base can be fabricated, for example, through a known process comprising supplying a plurality of filaments to a entangling (or entwining) apparatus in different rates with each other, and entangling a filament(s) supplied in the slower rate around a filament supplied in the faster rate to form the loops.

The number of loops in 10 cm of the loop thread used for producing the cover member (fabric) is preferably about 20 to 40 because use of such a loop thread realizes a cover member (fabric) having excellent female structures on the inner surface thereof.

A fabric (cover member) having a female structure on the inner surface (under or lower surface) thereof and a pile on the upper surface thereof can be obtained by weaving or knitting the above fabric (base) (1) with the loop having the female structure on the inner surface thereof, through

a thread for piling in the process of weaving or knitting the fabric.

[0039]

Moreover, the above cover member (fabric) (2) can be produced, for example, by producing (a) a fabric with a pile on the surface in advance, and laminating (b) another fabric which is previously formed and has a female structure on the inner surface of the fabric (a), by means of a laminating process (or lamination) or other suitable processes. In such a case, the fabric (b) having the female structure on the inner surface thereof may include, for example, a raising tricot fabric produced by using a false-twist finished yarn and the like. The raising surface of the raising tricot fabric has a good male-female engaging action with the male element on the surface of the tubular core member.

[0040]

The height, the number (pile density per unit area) and the like of piles on the upper surface of the cover member can be selected in the same way as the conventional paint roller, depending on a kind of the paint roller, a kind of the paint to be applied with the paint roller, a type of usage, and the like. The height of the pile is generally 3 to 30 mm, and particularly 5 to 25 mm. The density of the pile is 18 to 80/cm^2, particularly 20 to 50/cm^2. The cover member having such a pile is preferred in term of the paint-holding capacity, the painting uniformity, and

the like.

The pile on the surface of the cover member is preferably a cut pile rather than a loop pile, in term of the painting uniformity, the paint-holding capacity, the discharging facility and the like.

[0041]

Alternatively, in the above cover member (fabric) (1) having the loop exposed on the inner surface, (i) a fiber which constitutes the loop derived from the loop thread, (ii) other fibers constituting the base, and (iii) a fiber constituting a pile may be the same or different from each other.

[0042]

In the both cover members (1) and (2), the base and the pile of the fabric constituting the cover member can be, for example, made of a synthetic fiber such as a polypropylene fiber, a polyester fiber or a polyamide fiber, or a combination thereof. Among others, the base and the pile are preferably made of the polyamide fiber and/or the polyester fiber in term of the paint-holding capacity and the like.

The single fiber fineness (or size) of the fiber forming the base and the pile in the fabric constituting the cover member is not particularly limited to a specific one, and it is preferred that the fineness be about 1 to 20 dtex alike to a conventional paint roller.

[0043]

In the cover member used in the present invention, especially the cover member with the pile on the surface, it is important that the fiber such as the pile is not drop (shed, come off, or fall out) during the painting work operation (the fiber shedding does not occur), in order to form a good painted surface. Thus, it is necessary to prevent the pile from shedding from the cover member.

In a usual pile product such as a carpet, the product is generally treated on the inner (or under) surface thereof with a resin coating called a backing in order to prevent the pile from shedding. However, in the cover member used in the present invention, since the cover member comprises a loop(s) having the female structure and being exposed on the inner surface of the cover member, or other fiber(s) having the female structure and existing in the inner surface of the cover member, by such a backing process, the loop as well as the other fiber is buried into the resin coating layer (backing layer). Thus since the loop and other fiber cannot realize the female structure, the backing process employed in the usual pile product such as a carpet cannot be applied to the cover member of the present invention.

[0044]

Therefore, in order to avoid falling out the pile on the surface of the cover member, the present invention preferably adopts a process which comprises preparing a cover member (fabric) containing a heat-fusing fiber in the base by using a heat-fusing fiber (a thread comprising

a heat-fusing fiber) as one kind of a ground yarn constituting the base, melting (or fusing) the cover member (fabric) with heating at a temperature of not lower than the melting point of the heat-fusing fiber, and welding the molten heat-fusing fibers among themselves as well as the molten heat-fusing fiber with a fiber forming a pile and the like or with other fibers in the base. Use of the above process realizes the avoidance of the displacement of the loop exposed on the inner surface of the cover member because of the prevention of the pile from falling out and the firm welding of the loop thread in the base. Thereby the engagement can be more favorably exhibited.

Further, use of the heat-fusing fiber ensures the repression of the variation in the width of the cover member due to the tension applied to the cover member during winding the cover member around the core member caused by melting and welding between fibers in the base.

The proportion of the heat-fusing fiber in the production of the cover member is not limited to a specific one. It is generally preferable that the proportion be about 30 to 100% by mass relative to a total mass of the thread constituting the base, in term of function for welding the pile, the dimensional stability of the cover member, and the like.

[0045]

As the heat-fusing fiber, there may be used a fiber constituting a foundation (substrate) of the base, or a

fiber excellent in the heat-weldability with the pile thread forming the pile, and at least part of the fiber is molten (softened or fused) at a lower temperature. The heat-fusing fiber is not limited to a specific one, and for example, may include a conjugated fiber having a sheath-core or a sea-island structure, in which a sheath component or an ocean component comprises a polyethylene and a core component or an island component comprises a polypropylene, or a mixed spun fiber thereof; a conjugated fiber having a sheath-core or a sea-island structure, in which a sheath component or an ocean component comprises an ethylene- vinyl alcohol copolymer and a core component or an island component comprises a polypropylene, a polyester or a polyamide, or a mixed spun fiber thereof; a conjugated fiber having a sheath-core or a sea-island structure, in which a sheath component or an ocean component comprises a polyester having a lower melting point and a core component or an island component comprises a polyester having a higher melting point, or a mixed spun fiber thereof; a conjugated fiber having a sheath-core or a sea-island structure, in which a sheath component or an ocean component comprises a lower melting point polyamide and a core component or an island component comprises a higher melting point polyamide, or a mixed spun fiber; and others.

[0046]

According to the present invention, a non-woven fabric in addition to the above fabric comprising a woven fabric

used as the base, can be also used as the cover member. In the non-woven fabric, the loops constituting the female structure involved in the engagement are not exposed. However, since the fibers in the non-woven fabric are entangled with each other and fixed, when the male element on the outer surface of the tubular core member digs into the inside from the inner surface of the non-woven fabric, the male element is hooked on the entangled fibers to give the male-female engagement. Therefore, the cover member comprising the non-woven fabric can be fixed and attached to the surface of the tubular core member by the male-female engagement between the cover member and the male element on the surface of the tubular core member.

[0047]

However, in some cases, a short fiber fallen off from the cover member comprising the non-woven fabric may soil (or make dirty) the painted surface. Thus, depending on the required performance of a surface to be painted, it is preferred to use a non-woven fabric as the cover member in the case of not causing any problems.

Moreover, an attention should be paid for using a non-woven fabric as the cover member because the non-woven fabric generates a line on the painted surface due to a wound joint on the surface of the tubular core member, the wound joint which is caused by winding the non-woven fabric around the tubular core member and is sometimes remained. However, in an effect roller in which the cover member cut

into a given size and dimension, is attached to the surface of the tubular core member in a given pattern, there is no problem by nature so that the non-woven fabric can also be used efficiently as the cover member.

[0048]

The thickness, the weight, and the like of the cover member are not particularly limited to a specific one, and can be selected based on a kind, an application, a type of use and the like of the paint roller. From the viewpoint of the paint-holding capacity, the painting uniformity, the handleability, the winding property and the like, the thickness of the cover member is generally preferably 2 to 30 mm and particularly 4 to 25 mm [in the case where the cover member is a pile fabric, the thickness includes the pile part], and the weight is preferably 200 to 1000 g/m^2 and particularly preferably 500 to 900 g/m^2.

[0049]

The paint roller according to the present invention is produced by the following steps: fixing the cover member having the female structure on the inner surface thereof to the surface of the tubular core member with the male element on a surface thereof by means of the male-female engagement between the male element and the female structure on the inner surface of the cover member, to prepare a tubular body for the paint roller covered with the cover member entirely or partially; cutting the roller into a given dimension of the paint roller; and then attaching a handle

thereto. The same handle as the conventionally used one can be employed as the handle to be attached, depending on an application and a type of usage of the paint roller.

In the case where the cover member comprises the pile fabric, before or after cutting the fabric into a given dimension, it is preferred that the fluff (or fuzz) be finished by brushing and others.

[0050]

Upon the distribution and sale of the paint roller of the present invention, in order to exchange the cover member which becomes dirty, damaged, or worn, one or not less than two of a spare (replacement) cover member(s) may be distributed or sold in combination with the paint roller. Moreover, the cover member alone may be distributed or sold as "a cover member for a paint roller", so that a user of the paint roller can separately buy only the cover member to exchange the old cover member which becomes dirty, damaged, or worn.

[0051]

The present invention is illustrated in detail referring to the drawings as following, but the present invention is not limited to these specific examples in any way.

Fig. 2 (a) is a view showing an example of a process for producing a tubular body for a paint roller which comprises a tubular core member and a cover member, in which the cover member is attached (fixed) to the surface of tubular

core member. Fig. 2 (b) is a view showing an example of a tubular core member having a male element on a surface thereof.

In Fig. 2, symbol 1 shows a non-rotating (or static) mandrel; symbol 2 shows a strip-shaped sheet (tape) comprising a thermoplastic resin such as a polypropylene; symbol 3 shows an applicator for supplying a molten thermoplastic resin (e.g., a polypropylene) in the tape-shaped (band-shaped) form; symbol 4 shows a molten thermoplastic resin tape; symbol 5 shows a male tape comprising a thermoplastic resin such as polypropylene, with a male element on the outer surface; symbol 6 shows a tubular core member with the male element on a surface thereof; symbol 7 shows a feeding belt for rotating the tubular core member 6 around the mandrel 1 and displacing downstream the tubular core member 6; symbol 8 shows a cover member; and symbol 9 shows a male element.

[0052]

The strip-shaped sheet 2 made of the thermoplastic resin is supplied at a given angle and spirally wound around the non-rotating mandrel 1, and the molten thermoplastic resin tape 4 is supplied from the applicator 3 onto the strip-shaped sheet 2 which is wound around the mandrel 1. Further, while a molten state of the thermoplastic resin tape 4 is kept, the male tape 5 with the male element 9 on the outer surface thereof is wound spirally around the molten thermoplastic resin tape 4. By the hot-melt adhesive

action of the molten thermoplastic resin tape 4, the strip-shaped tape 2 wound around the mandrel 1 is adhered to the male tape 5 and united into one piece to form the tubular core member 6 of the roller with the male element on a surface thereof as shown in Fig. 2 (b). Further, the tubular core member 6 is rotated on the mandrel 1 and fed downstream by the feeding belt 7, and the cover member 8 is attached onto the surface of the tubular core member 6 by the male-female engagement between the male element 9 on the surface of the tubular core member 6 and the female element on the inner surface of the cover member 8 with spirally winding the cover member 8 around the core member 6, to produce the tubular body for the paint roller of the present invention. Incidentally, in the production process shown in Fig. 2 (a), upon feeding the tubular core member 6 to the downstream by the feeding belt 7 with rotating around the mandrel 1, the strip-shaped sheet 2 which exists in the upstream side of the cover member 6 is also wound around the mandrel 1, with rotating on the mandrel 1. Thereafter, the tubular body for the paint roller covered with the cover member obtained in Fig. 2 (a) is cut into a given dimension with a cutting device (not shown), and then a handle is attached to the cut tubular body to produce the paint roller. At that time, the outer surface of the cover member is optionally brushed to finish the fluff on the outer surface thereof, before or after the cutting.

[0053]

Fig. 3 (a) is a view showing an example of a cover member used in a paint roller of the present invention. Moreover, Fig. 3 (b) is a view showing an example of a loop thread used in the production of the cover member of Fig. 3 (a). In Fig. 3, symbol 8 shows a cover member; symbol 10 shows a weft (or woof) constituting a base; symbol 11 shows a loop; and symbol 12 shows a pile.

The cover member 8 shown in Fig. 3 (a) is produced by using the loop thread illustrated in Fig. 3 (b) as part of the thread for the base upon weaving or knitting the cover member 8. Thereby, many loops 11 exist with exposing on the inner surface of the cover member 8. The loop 11 has the female structure and is connected to the male element 9 existing on the outer surface of the tubular core member 6 shown in Fig. 2 (b) by the male-female engagement therebetween. Thereby the cover member 8 can be stably attached to the surface of the tubular core member 6.

[0054]

As shown in Fig. 2 (a), the cover member 8 is attached to all over the outer surface of the tubular core member 6 by winding and so on to produce a paint roller 13 (a tubular body for a paint roller), which has the tubular core member 6 covered with the cover member 8 entirely, as shown in Fig. 4 (a).

Moreover, as illustrated in Fig. 4 (b), in the case of using a cover member piece 8' having a given shape and dimension (as a cover member 8), the cover member piece

8' is attached to the surface of the tubular core member 6 in a given pattern by the male-female engagement between the male element 9 and the female structure on the inner surface of the cover member piece 8', to produce an effect roller 14 having the given pattern shown in Fig. 4 (b). In the effect roller shown in Fig. 4 (b), the kind of the pattern can be variously altered by changing the shape, the size, the arrangement, the number and others of the cover member piece 8'. Such an alteration can be easily conducted at the site of the painting working operation.

[Examples]

[0055]

The following examples and others are intended to describe this invention in further detail and should by no means be interpreted as defining the scope of the invention.

In the following examples, the measurement and evaluation was carried out as below.

[0056]

(1) Measurement of the height of the male element:

The male element part formed on the male tape was observed with a Digital HF microscope ("VH-8000" manufactured by Keyence Corporation) at the 50-power magnification to measure the distance between the bonding part of the support of the male element to the sheet-shaped basis and the highest part (top) of the male element (height (H) shown in Fig. 1), and the measured value was expressed

as the height of the male element (mm).

[0057]

(2) Measurement of the male-female engagement strength:

As shown in Fig. 5, in the paint roller comprising the tubular core member 6 of the roller and the cover member 8 wound spirally around the surface of the core member, the cover member 8 was peeled by 5 cm from the tubular core member 6, one end thereof was grasped with a chuck of an Instron testing machine ("Auto AGS-100" manufactured by Shimadzu Corporation) in a width (width in the vertical (perpendicular) direction) of 1 cm, then an iron core 16 was put through the tubular core member 6, both ends of the iron core 16 were fixed. After that, the chuck 15 of Instron testing machine was lifted at a rate of 300 mm/min. to measure the peel strength at that time as the male-female engagement strength. Incidentally, as the chuck 15 is elevated, the cover member 8 is peeled from the surface of the tubular core member 6 with rotating.

[0058]

(3) Assessment of the painting performance:

A paint (160 g, "One-component Fine Urethane U100" manufactured by Nippon Paint Co., Ltd.) was held on the surface of a paint roller, the paint roller was reciprocated 100 times (there and back) on a coated paper (100 times there and back on the same zone of the paper) to paint the paper (without resupplying the paint to the paint roller during the process), and the aesthetics (appearance) of

a paint film finished was visually observed and evaluated.

[0059]

<<EXAMPLE 1>>

(1) Production of a loop thread:

One nylon filament thread (140 dtex/14 filaments; manufactured by Toray industries, Inc.) as a sheath thread and one heat-fusing fiber (a sheath-core type conjugated fiber in which the core component comprised a polyethylene terephthalate and the sheath component comprised an ethylene-vinyl alcohol-series copolymer; 165 dtex/48 filaments) as a core thread was fed to Taslan (a registered trademark of Heberlein Fiber Technology Inc.) nozzle ("#15" manufactured by Heberlein) at a feed rate of the core thread of 1.10 and a feeding rate of the sheath thread of 1.50, and subjected to Taslan process under an air pressure of 540 kPa (5.5 kg/cm^2) and a processing speed of 200 m/min. to produce a process thread (loop thread) having 410 dtex/62 filaments (the average loop number per cm of the thread: 22).

[0060]

(2) Production of a cover member:

Two polyester filament threads (276 dtex/48 filaments) were provided for pile threads. One loop thread obtained from the above (1) and one heat-fusing thread (filament thread; 165 dtex/48 filaments; "Sophista" manufactured by Kuraray Co., Ltd.) were used as ground yarns. The above ground yarns (the loop thread and the heat-fusing

thread) were pulled and aligned and knitted with a circular knitting machine with applying a tension of 10 g to the heat-fusing fiber filament to give a cover member (woven fabric) having a pile made of the polyester filament thread on the upper surface (pile density: 21 /cm^2, average pile height: 7 mm), and having many loops of nylon filament exposed on the inner surface (weight of the woven fabric: 560 g/m^2, thickness of the woven fabric: 6 mm).

[0061]

(3) Production of a paint roller:

(i) As shown in Fig. 2 (a), a strip-shaped polypropylene sheet in a width of 50 mm was wound spirally around a mandrel 1 (outer diameter of 3.8 cm), while allowing a heat-fused (molten) polypropylene in the form of a tape to flow down from an applicator 3 onto the sheet in an application amount of 0.03 g/cm^2 and apply the molten polypropylene for spirally winding around the strip-shaped polypropylene sheet, and then a male tape of a separable fastener made of a polypropylene in a width of 50 mm (height of a male element: 0.7 mm, density of a male element: 81 /cm^2) ("MAGILOCK" manufactured by Kuraray Co., Ltd.) was spirally wound and fixed around the molten polypropylene (in an angle of 21° relative to the central axis of the mandrel 1).

(ii) Following the above step (i), the cover member obtained from the above (2) (cover member slit into a width of 50 mm) was spirally (in an angle of 21° relative to the

central axis of the mandrel 1) wound around the surface of the wound male tape, and the cover member was attached to the surface of the core member with a male-female engagement between the male element of the separable fastener male tape and the inner surface of the cover member to fabricate a tubular body for the paint roller covered with the cover member on the whole surface thereof.

[0062]

(iii) After cutting the tubular body for the paint roller fabricated in the above (ii) into 23 cm, brushing the surface to condition the fluff, followed by attaching a spring handle to the body, a paint roller was produced.

(iv) For the paint roller produced in the above (iii), the male-female engagement strength was measured by the above method prior to the attachment of the handle. As a result, the strength upon peeling was 10 to 26 g/cm, and it was confirmed that the cover member was sufficiently engaged with the surface of the tubular core member with the male element on the outer surface.

Moreover, the painting performance of the paint roller produced in the above (iii) was evaluated by the above method after the attachment of the handle. As a result, the painted surface did not have a transfer of the joint of winding. Thus, the paint roller was excellent in the painting performance. Moreover, the paint did not enter into the boundary portion of the tubular core member of the paint roller and the cover member upon the painting, and any problem

such as a paint leakage did not occur.

[0063]

<<EXAMPLE 2>>

(1) The same cover member as those obtained in EXAMPLE 1 (2) was adequately cut into a scrollwork pattern and a geometrical pattern to give a plurality of cover member pieces.

(2) A tubular core member with the male element on a surface thereof was produced by the same step as in EXAMPLE 1 (i), and this preparatory core member was directly cut into length of 23 cm (without attaching the cover member) to produce a tubular core member having the given length (23 cm).

(3) The plurality of cover member pieces produced in the above (1) were attached to the surface of the tubular core member in length of 23 cm produced in the above (2) at a space from each other, to give an effect roller.

(4) The painting with the effect roller produced in above (3) achieved that the same pattern design as the pattern on the surface of the effect roller was smoothly painted on a surface to be painted.

[0064]

<<EXAMPLE 3>>

(1) Production of the cover member:

(i) Two polyester filament threads (276 dtex/48 filaments) were provided for pile threads. Two polyester false-twisted filament threads (220 dtex/72 filaments) and

one heat-fusing fiber filament (filament thread; 165 dtex/48 filaments; "Sophista" manufactured by Kuraray Co., Ltd.) were used as ground yarns. The above ground yarns were aligned and knitted with a circular knitting machine to give a woven fabric having a pile made of the polyester filament thread on the upper surface (weight of the woven fabric: 540 g/m^2, thickness of the woven fabric: 6 mm, pile density on the upper surface: 22 /cm^2, and average pile height: 7 mm).

(ii) With the use of a polyester false-twisted thread (80 dtex/24 filaments), a tricot fabric (weight of the woven fabric: 150 g/m^2, thickness of the woven fabric: 1.5 mm) was produced, then one surface of the tricot fabric was raised with a raising machine to produce a tricot raising fabric.

(iii) The non-raising surface of the tricot raising fabric produced in the above (ii) was adhered to the non-piloerected surface (the surface having no pile formed) of the fabric produced in the above (i) by using a "Dynac" manufactured by Toyobo Co., Ltd. as an adhesive to laminate both fabrics, to give a laminated fabric (cover member).

[0065]

(2) Production of the paint roller:

(i) A paint roller was produced in the same way as in EXAMPLE 1, except for using the laminated fabric produced in the above (1) (iii) as the cover member.

(ii) For the paint roller produced in the above (i),

the male-female engagement strength was measured according to the above process. As a result, the strength upon peeling was 67 to 121 g/cm, and it was confirmed that the cover member was engaged with the surface of the tubular core member of the paint roller with the male element on the outer surface, in high engagement strength.

Moreover, the painting performance of the paint roller produced in the above (i) was evaluated by the above method. As a result, the painted surface did not have a transfer of the joint of winding, and the paint roller was excellent in the painting performance. Moreover, the paint did not enter into the boundary portion of the tubular core member of the paint roller and the cover member upon the painting, and any problems such as a paint leakage did not occur.

[0066]

<<COMPARATIVE EXAMPLE 1>>

(i) A paint roller was produced in the same manner as EXAMPLE 1, except for using a separable fastener male tape ("MAGILOCK" manufactured by Kuraray Co., Ltd.) in which the height of the male element is 3.8 mm and the density of the male element is 81/cm^2, as a polypropylene separable fastener male tape.

(ii) For the paint roller produced in the above (i), the male-female engagement strength was measured according to the above method. As a result, the strength upon peeling was 10 to 21 g/cm, and it was confirmed that the cover member was engaged with the surface of the tubular core member

with the male element on the outer surface, in the sufficient engagement strength. However, the paint entered into the gap or void at the boundary between the tubular core member and the cover member upon painting, and a paint leakage occurred. As a result, a regular diagonal line appeared on the painted surface, and the paint roller could not perform a uniform painting.

[0067]

<<COMPARATIVE EXAMPLE 2>>

(i) A paint roller was produced in the same manner as EXAMPLE 1, except for using a separable fastener male tape ("MAGILOCK" manufactured by Kuraray Co., Ltd.) in which the height of the male element is 0.1 mm and the density of the male element is 81/cm^2, as a polypropylene separable fastener male tape.

(ii) For the paint roller produced in the above (i), the male-female engagement strength was measured according to the above method. As a result, the strength upon peeling was extremely low, 1 to 4 g/cm, that is, the male element on the surface of the tubular core member was hardly engaged with the inner surface of the cover member.

[Industrial Applicability]

[0068]

The paint roller of the present invention is useful for a resource-saving paint roller, because the dirty, damaged, or worn cover member is removable from the surface of the tubular core member and easily exchangeable for a

new cover member, such that the tubular core member is usable repeatedly.

The paint roller of the present invention is useful for an effect roller which can freely and conveniently change a painting pattern to be painted on a surface of an object, because the paint roller comprises a cover member piece having a given shape and dimension, as the cover member for attaching to the surface of the tubular core member in any pattern.

[Brief Description of the Drawings]

[0069]

[Fig. 1] Fig. 1 is a view showing shapes of examples in which each male element present on the surface of a tubular core member constituting a paint roller of the present invention.

[Fig. 2] Fig. 2 (a) is a view showing an example of a process for producing a tubular body used in a paint roller of the present invention. Fig. 2 (b) is a view showing an example of a tubular core member in a paint roller of the present invention.

[Fig. 3] Fig. 3 (a) is a view showing an example of a cover member used in a paint roller of the present invention. Fig. 3 (b) is a view showing an example of a loop thread used in the production of the cover member of Fig. 3 (a).

[Fig. 4] Fig. 4 is a view showing examples of a paint roller of the present invention. Fig. 4 (a) is a view showing an example of a paint roller having a cover member attached

all over the tubular core member. Fig. 4 (b) is a view showing an example of an effect roller having a plurality of pieces of the cover member of a given shape and dimension attached to the surface of the tubular core member in a given pattern.

[Fig. 5] Fig. 5 is a view illustrating a method for measuring a male-female engagement strength between a male element on the surface of the tubular core member and a female structure on the inner surface of the cover member in EXAMPLES and COMPARATIVE EXAMPLES.

[Description of Reference Numerals]

[0070]

1 Mandrel
2 Thermoplastic resin tape
3 Applicator
4 Molten thermoplastic tape film
5 Separable fastener male tape
6 Tubular core member
7 Feeding belt
8 Cover member
8' Cover member piece
9 Male element
10 Weft
11 Loop
12 Pile
13 Paint roller
14 Effect roller
15 Chuck

16 Iron core

[Abstract]

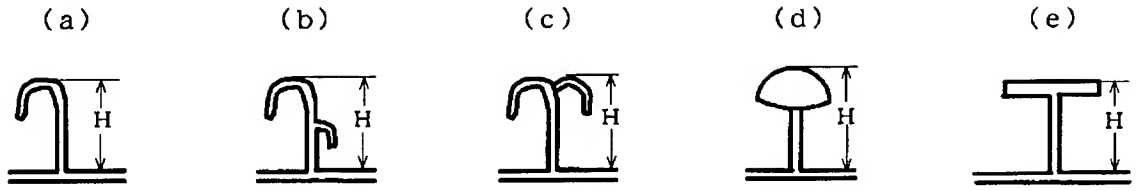
[Object(s)] To provide a paint roller comprising a roller body and a cover member attached to the roller body and an effect roller in which a painting pattern by the paint roller is freely changeable according to each aspect. In the paint roller, the cover member is removable from the roller body and exchangeable for a new cover member, when the cover member becomes dirty, damaged, or worn. The paint roller can provide a good painted surface.

[Means to Solve the Problems] The paint roller comprises a liquid-impermeable tubular core member and a cover member attached on a surface of the core member, wherein the core member has an engaging element having a male structure of a separable fastener on a surface thereof, and the engaging element has a height of 0.3 to 3.5 mm, the cover member has a female structure of a separable fastener on an inner surface thereof, and the core member is attached to the cover member with a male-female engagement between the male structure of the surface of the tubular core member and the female structure of the inner surface of the cover member.

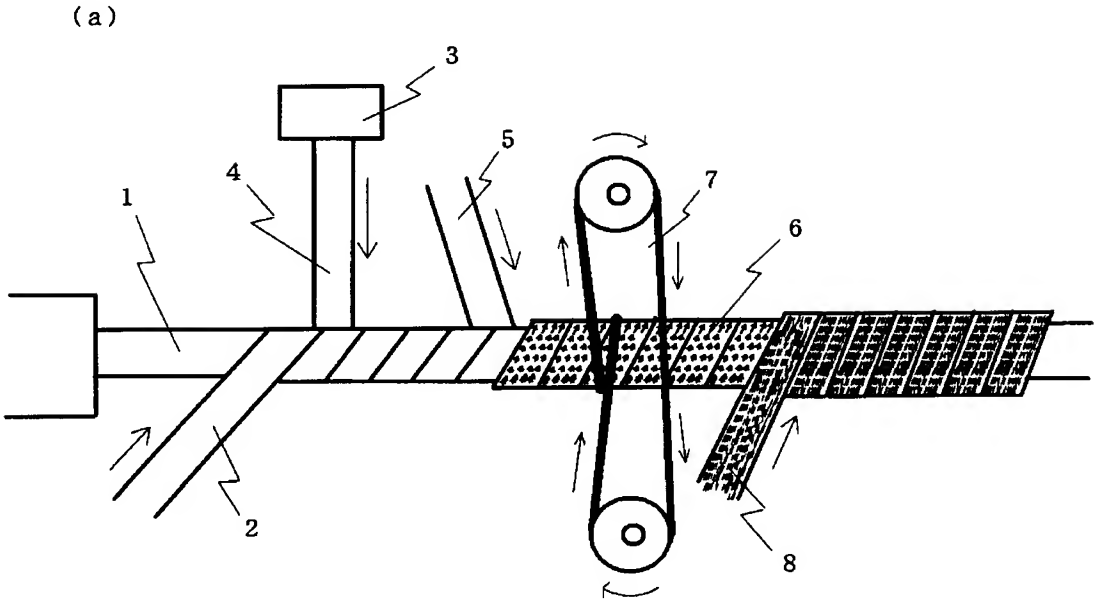
[Selected Fig.] Figure 2

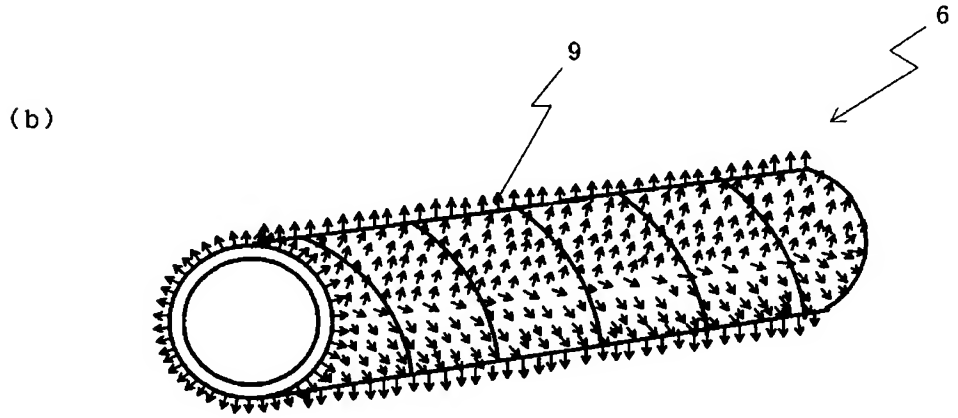
[Document Name] Drawings

[Figure 1]

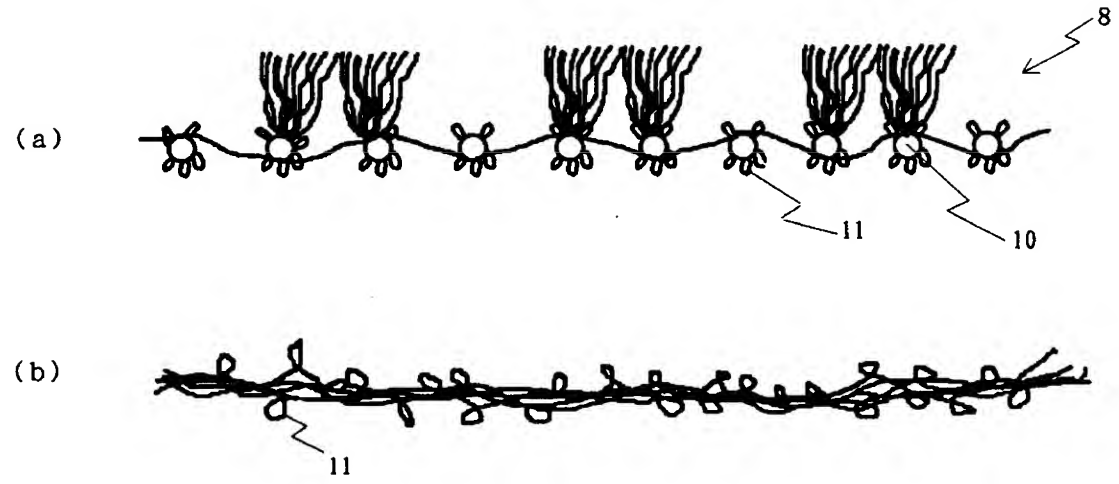


[Figure 2]

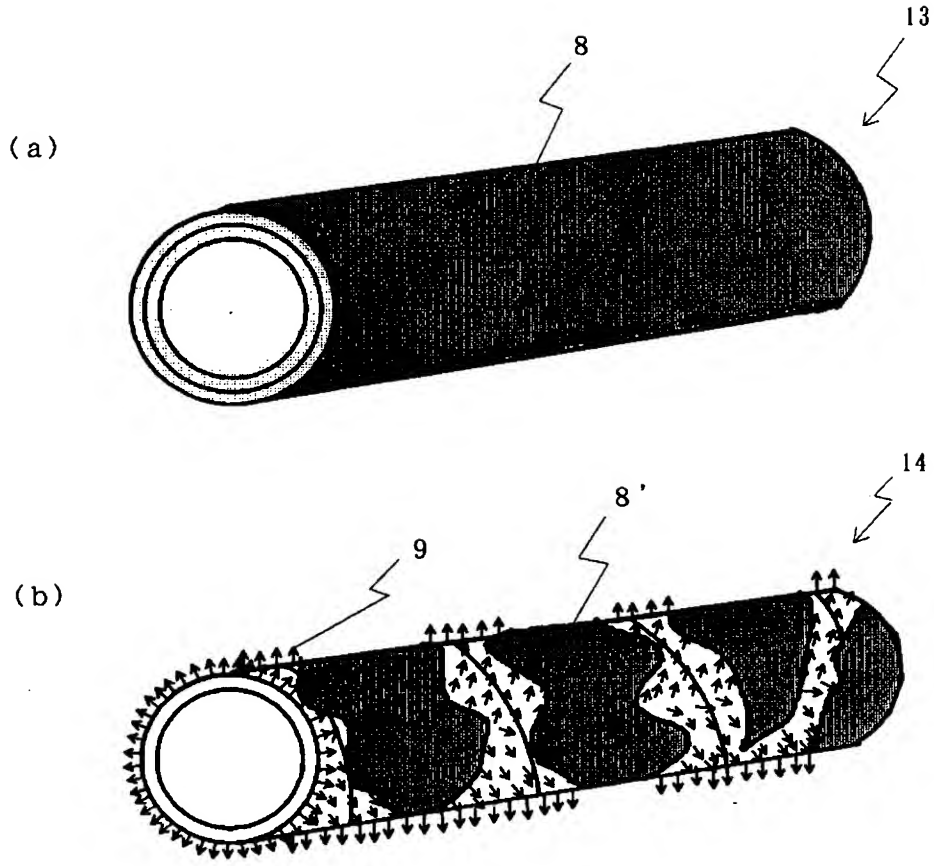




[Figure 3]



[Figure 4]



[Figure 5]